

CHAPTER 6

BIOLOGICAL RESOURCES

Introduction

The Delaware Direct Watershed is part of the Upper Estuary of the Delaware River, a tidal zone with free-flowing waters south of Trenton and north of the Delaware Bay. The Upper Estuary is characterized by intertidal wetlands fed by freshwater streams and is part of a larger ecosystem that provides habitat for both transient and resident species. The river is a stop in the Atlantic flyway for migratory birds, as well as a thoroughfare for anadromous fish (fish that move from salt water to fresh water to reproduce).

The Delaware River has been heavily altered from pre-European settlement in the 17th century, with only a few remaining ecological communities. Early development activities such as deforestation, dredging, shoreline hardening and filling have contributed to decreased water quality, diminished habitat for terrestrial and aquatic species, and overall reductions or extirpation of commercial fisheries within the region. At the time of colonization, Philadelphia contained 10 to 20 square miles of tidal marshland, primarily located along the Schuylkill and Delaware rivers.¹ This area has been transformed and is now populated by industrial complexes, public works and the Philadelphia International Airport. These alterations have severely affected the aquatic ecosystems that depend on the tidal marsh. The tidal marsh filters water, contains floodwaters and provides habitat for hundreds of species of birds, mammals, fish and reptiles along with an untold number of plants, insects and other invertebrates. The only remaining large contiguous tract – a 200-acre (<1/3 square mile) remnant of tidal marsh – can be found within the John Heinz National Wildlife Refuge at Tinicum. This is also one of the only federally owned wetland parcels in Pennsylvania.

Although Philadelphia has one of the most developed waterfronts in the state, it contains a number of species that are confined to the tidal reaches of the Delaware River. Many of these plant species, such as Subulate arrowhead (*Sagittaria subulata*), Spatterdock (*Nuphar polysepala*), Arrow Arum (*Peltandra virginica*), Pickerel weed (*Pontaderia cordata*), and Multiflowered mud-plantain (*Heteranthera multiflora*), are only found in tidal mudflats. Mudflats are areas of fine silt that occur in tidal areas. These intertidal areas are typically exposed during low tide but are covered with water during high tide.

¹ Pennsylvania Natural Heritage Program, A Natural Heritage Inventory of Philadelphia County, Pennsylvania, 2008

6.1 - Wildlife

6.1.a - Terrestrial Wildlife

Mammals

The urbanization of Philadelphia has caused the disappearance of many mammalian species such as the Eastern cougar (*Puma concolor cougar*), the Grey wolf (*Canis lupus*), the Harp seal (*Pagophilus groenlandicus*) and the Harbor seal (*Phoca vitulina*). Philadelphia has several other mammals that reside in the City. These species are a reminder of the diversity of wildlife that used to exist in Philadelphia. White-tailed deer (*Odocoileus virginianus*), Red fox (*Vulpes vulpes*), Opossum (*Didelphis virginiana*), Raccoon (*Pryacon lotor*), North American beaver (*Castor canadensi*), Grey squirrel (*Sciurus carolinensis*), and the Chipmunk (*Tamias striatus*) are all seen in Philadelphia. Squirrels, mice, chipmunks and birds serve as seed dispersers, moving seeds away from the competition of the parent plant by either eating the fruit or otherwise carrying the seed to another location. By doing this, they increase biodiversity in areas they frequent. Surprisingly, bats also have a presence in the City. They feed on insects over bodies of water, such as the Delaware River, at night. The Little brown bat (*Myotis lucifugus*) and Eastern pipistrelle (*Pipistrellus subflavus*) are found in the City but travel in the winter to the suburbs in order to hibernate in caves. Some species have been introduced to life in the City, such as feral cats and dogs. When they are released from human care, these domesticated pets can be destructive to wildlife and also have been known to outcompete native species from certain areas. The Norway rat (*Rattus norvegicus*) was also introduced into this area. ²

Birds

Philadelphia's location within the Atlantic Flyway makes it an important potential habitat for migratory birds to over-winter, breed and rest. Human encroachment into marshland habitats has caused diminished mating and resting grounds in the greater Philadelphia region. Many of the indigenous species found in Tinicum Marsh have been listed on the State's rare, threatened or endangered list. Thousands of other birds use Tinicum as a resting area during migration in the spring and fall. Other common birds are more readily adapted to urban settings where there are many places to nest, hide and feed. Many gull species found in the open water of the Delaware Bay or in the Atlantic Ocean travel up the shoreline to Philadelphia. Here, they will feed, mature and rest before returning to the open waters.³ For more information on recent bird sightings as well as a complete list of observed birds, visit [John Heinz National Wildlife Refuge](#) on the web.

² NHI, 2008

³ NHI, 2008

Table 6.1- Terrestrial Wildlife Species of Concern

Scientific Name	Common Name	Status
<i>Ardea herodias</i>	Great Blue Heron	Secure G
<i>Asio flammeus</i>	Short-eared Owl	Secure G, Endangered S P
<i>Atrytonopsis hianna</i>	Dusted Skipper	Imperiled R
<i>Botaurus lentiginosus</i>	American Bittern	Apparently Secure G, Endangered S P
<i>Callophrys gryneus</i>	Juniper Hairstreak	Secure G, Vulnerable R
<i>Casmerodius albus</i>	Great Egret	Secure G, Endangered S P
<i>Celithemis eponina</i>	Halloween Pennant	Secure G
<i>Circus cyaneus</i>	Northern Harrier	Secure G
<i>Cistothorus palustris</i>	Marsh Wren	Secure G
<i>Datana ranaeeps</i>	A Hand-maid Moth	Critically Imperiled R
<i>Enallagma durum</i>	Big Bluet	Secure G, Vulnerable R
<i>Euphyes conspicuus</i>	Black Dash	Apparently Secure G, Vulnerable R
<i>Falco peregrinus</i>	Peregrine Falcon	Apparently Secure G, Endangered S P
<i>Glyptemys muhlenbergii</i>	Bog Turtle	Vulnerable G, Imperiled R, Endangered S P, Threatened F
<i>Gomphaeschna antilope</i>	Taper-tailed Darner	Apparently Secure G, Historical R
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Secure G, Threatened S P
<i>Hemileuca maia</i>	Barrens Buckmoth	Secure G
<i>Hesperia metea</i>	Cobweb Skipper	Imperiled R
<i>Ixobrychus exilis</i>	Least Bittern	Secure G, Endangered S P
<i>Kinosternon subrubrum</i>	Eastern Mud Turtle	Secure G, Critically Imperiled R, Extirpated P
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	Secure G
<i>Libellula incesta</i>	Slaty Skimmer	Secure G
<i>Libellula needhami</i>	Needham's Skimmer	Secure G, Historical R
<i>Lycaena hyllus</i>	Bronze Copper	Secure G, Vulnerable R
<i>Nastra lherminier</i>	Swarthy Skipper	Secure G, Vulnerable R
<i>Nicrophorus americanus</i>	American Burying Beetle	Historical R, Endangered F
<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	Secure G, Endangered S P
<i>Pandion haliaetus</i>	Osprey	Secure G, Threatened S P
<i>Papilio cresphontes</i>	Giant Swallowtail	Secure G, Imperiled R
<i>Phoca vitulina</i>	Harbor Seal	Secure G
<i>Podilymbus podiceps</i>	Pied-billed Grebe	Secure G
<i>Pseudemys rubriventris</i>	Redbelly Turtle	Secure G, Threatened S
<i>Rana sphenoccephala</i>	Coastal Plain Leopard Frog	Secure G, Critically Imperiled R, Endangered S P
<i>Satyrium titus</i>	Coral Hairstreak	Secure G, Vulnerable R
<i>Speyeria idalia</i>	Regal Fritillary	Vulnerable G, Critically Imperiled R
<i>Stylurus plagiatus</i>	Russet-tipped Clubtail	Secure G, Critically Imperiled R
<i>Tyto alba</i>	Barn Owl	Secure G

G: Global status R: State Rank S: State Status P: State Proposed Status F: Federal Status
 (For clarifications on statuses see Table 6.2)

Source: [Pennsylvania Natural Heritage Program](#)

Table 6.2- Concern Species Levels

Term	Definition
Secure	Common; at least 10,000 individuals with 100 occurrences
Apparently Secure	Uncommon; around 10,000 individuals with 100 occurrences
Vulnerable	Rare in Range or only found in restricted range; 3,000-10,000 individuals with 21-100 occurrences; In danger of population decline due to human influences (removal, habitat destruction)
Imperiled	Rare; 1,000-3,000 individuals or 2,000-10,000 acres, or 10-50 river miles with 6-20 occurrences
Critically Imperiled	Near Extinction; less than 1,000 individuals, or 2,000 acres, or 10 river miles with less than 5 occurrences
Possibility Extinct	Historical occurrences with hope of individual cases undiscovered
Extirpated	Thought to be extinct in the area of study with little chance of any remaining individuals
Endangered	Extreme danger of extinction throughout range in Pennsylvania
Threatened	May soon become Endangered within Pennsylvania's natural range for the given species
Rare	Given population is removed from main population, or only found in specific restricted range, or limitations in range
Accidental	Not normally found in area, does not spend a significant period of time in area, sometimes lost
Candidate	Possibility for status, but has not been approved for concern

Source: [Pennsylvania Natural Heritage Program](#)

6.1.b - Aquatic Wildlife

Fish

Resident and migratory fish communities within the Delaware Basin have historically been subjected to various human influences, including legacy pollution, over-fishing and habitat modifications. In 2009, the Philadelphia Water Department (PWD), with grant support from Pennsylvania's Department of Conservation and Natural Resources (DCNR), performed an ecological survey of the southern portion of the Delaware River's waterfront. More than 2,400 fish were captured, identified, measured and released back into the river (Table 6.3). Seasonal differences in fish community structure was expressed with the predominance of juvenile river herring and American shad in the

late summer months. These findings suggest that the river in our region is serving as a nursery area for anadromous fish species (species that move from salt water to fresh water in order to reproduce).⁴

Table 6.3-Fish species identified during the spring and summer surveys (PWD, 2009)

Scientific Name	Common Name	Number of Captures
<i>Alosa aestivalis</i>	Blueback herring	1195
<i>Alosa sapidissima</i>	American shad	493
<i>Alosa pseudoharengus</i>	Alewife	214
<i>Hybognathus regius</i>	Eastern silvery minnow	180
<i>Morone americana</i>	White perch	85
<i>Dorosoma cepedianum</i>	Gizzard shad	73
<i>Morone saxatilis</i>	Striped bass	38
<i>Ictalurus punctatus</i>	Channel catfish	34
<i>Brevoortia tyrannus</i>	Atlantic menhaden	25
<i>Cyprinus carpio</i>	Common carp	24
<i>Lepomis</i> spp.	Sunfish species	15
<i>Anguilla rostrata</i>	American eel	9
<i>Perca flavescens</i>	Yellow perch	9
<i>Lepomis gibbosus</i>	Pumpkinseed sunfish	5
<i>Lepomis macrochirus</i>	Bluegill sunfish	4
<i>Cyprinella analostana</i>	Satinfin shiner	2
<i>Micropterus salmoides</i>	Largemouth bass	2
<i>Anchoa mitchilli</i>	Bay anchovy	1
<i>Fundulus diaphanus</i>	Banded killifish	1
<i>Micropterus dolomieu</i>	Smallmouth bass	1
<i>Notropis hudsonius</i>	Spottail shiner	1

Source: Philadelphia Water Department Technical Memorandum: Ichthyofaunal Survey, 2009

Atlantic Shad

The Atlantic shad (*Alosa sapidissima*) (Figure 6.1) has a history of mirroring the Delaware River’s health in Philadelphia. At its peak in the 1800s, the shad population catch was at 16 million pounds. During this same period, dams near the headwaters were being built and industrial pollution was contributing to the reduced concentrations of dissolved oxygen in the Delaware River. The last one million pound catch was in 1916. Shad populations in the Philadelphia region still have not fully recovered from legacy impacts; however, with the continued improvements in water quality, removal of historical dams and management strategies implemented by the Pennsylvania Fish &

⁴ Philadelphia Water Department, Technical Memorandum: Ichthyofaunal Survey, 2009

Boat Commission (PFBC), American shad are slowly making a return to Philadelphia and its major tidal tributaries. ⁵



Figure 6.1- Philadelphia Water Department staff (biologist Joe Perillo) holding an American shad PWD, 2009

Eels

The American eel (*Anguilla rostrata*) also faces a population crisis with numbers at historic lows. A variety of factors has caused this population decline, including habitat loss, predation and disease. However, the American eel is still quite common in the Delaware River and represents a significant number of the world's American eel population. The life cycle of the American eel is complex, but an illustration of various life stages is shown in Figure 6.2. American eels start their life as eggs in the Sargasso Sea, where they mature from the larval stage to glass eels. From there, juvenile eels move to a freshwater habitat, such as the Delaware River, and mature from elvers to yellow eels to adult silver eels. ⁶

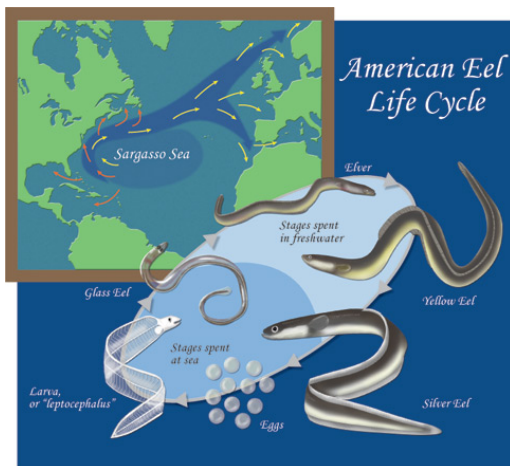


Figure 6.2- Life Cycle of American eel

Source: [Natural History Magazine: American Eel Life Cycle](#)

⁵ NHI, 2008

⁶ NHI, 2008

Mussels and Oysters

Bivalves are invertebrates with hinged shells (e.g., oyster, clam, or mussel). Bivalve reefs absorb wave energy, protecting salt marshes, trapping sediment and reducing bank erosion. They can also provide other ecosystem services, such as water filtration, habitat creation, carbon sequestration, benthic algae mats and nutrient sinks.⁷ A list of bivalves in the Delaware River is presented in Table 6.4.

Table 6.4-Bivalves in the Lower Delaware Watershed

Scientific name	Common name	State Status
<i>Alasmindonta heterodon</i>	Dwarf wedgemussel	Imperiled
<i>Alasmindonta undulata</i>	Triangle floater	Vulnerable
<i>Alasmindonta varicosa</i>	Brook floater	Imperiled
<i>Anodonta implicata</i>	Alewife floater	Vulnerable
<i>Elliptio complanata</i>	Eastern elliptio	Secure
<i>Lampsilis cariosa</i>	Yellow lampmussel	Vulnerable
<i>Lampsilis radiata</i>	Eastern lampmussel	Imperiled
<i>Lasmigona subviridis</i>	Green floater	Imperiled
<i>Leptodea ochracea</i>	Tidewater mucket	Critically Imperiled
<i>Ligumia nasuta</i>	Eastern pondmussel	Critically Imperiled
<i>Margariteifera margariteifera</i>	Eastern pearlshell	Imperiled
<i>Payganodon cataracta</i>	Eastern floater	Vulnerable
<i>Strophitus undulatus</i>	Squawfoot	Apparently Secure

(For clarifications on statuses see Table 6.2)

Source: Kreeger, Healthy Bivalves = Healthy Watersheds: Rebuilding Bivalve Biodiversity, Populations and Ecosystem Services as a Basis for Ecosystem Restoration, 2009

Freshwater mussels are extremely sensitive organisms and are one of the most imperiled animals in North America. A majority of the continent's species are in decline. Of the 12 species native to the Delaware River Basin, almost all are classified as reduced, threatened or locally extinct. Loss of habitat and pollution are two common causes for the declining mussel population.

In 2010, scientists from the Academy of Natural Sciences and the Partnership for the Delaware Estuary discovered seven species of freshwater mussels in the Delaware River between Chester, PA and Trenton, NJ. Two of these species were previously considered locally extinct. [Dr. Danielle Kreeger](#), science director at the Partnership for the Delaware Estuary, explained, "We have so few mussels left in almost all of our streams in the area, so to find seven species living together in dense communities right near Philadelphia was unexpected and cause for celebration."⁸ Visit the [Partnership for the Delaware Estuary](#) for more information on their activities in the watershed.

⁷ Danielle Kreeger and David Bushek, Mussel Powered Living Shorelines for Salt Marsh Erosion Control, 2010

⁸ Shaun Bailey, Freshwater Mussels Discovered in Urban Delaware River

There are several other aquatic species identified as species of concern. These lists help bring awareness to species that need protection. Table 6.5 lists species of concern in Philadelphia.

Table 6.5-Aquatic Wildlife Species of Concern

Scientific Name	Common Name	Status
<i>Alasmidonta heterodon</i>	Dwarf wedgemussel	Critically Imperiled R, Endangered S P F
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	Vulnerable G, Critically Imperiled R, Endangered S P F
<i>Acipenser oxyrinchus</i>	Atlantic sturgeon	Vulnerable G, Critically Imperiled R, Endangered S P, Candidate F
<i>Alasmidonta varicosa</i>	Brook floater	Vulnerable G, Imperiled R, Endangered P
<i>Lasmigona subviridis</i>	Green floater	Vulnerable G, Imperiled R
<i>Lampsilis cariosa</i>	Yellow lampmussel	Vulnerable G, Vulnerable S
<i>Ligumia nasuta</i>	Eastern pondmussel	Apparently Secure G, Critically Imperiled R
<i>Phocoena phocoena</i>	Harbor porpoise	Secure G, Accidental S
<i>Anodonta implicata</i>	Alewife floater	Secure G
<i>Aphredoderus sayanus</i>	Pirate perch	Secure G, Extirpated R P
<i>Enneacanthus obesus</i>	Banded sunfish	Secure G, Critically Imperiled R, Endangered S P
<i>Gasterosteus aculeatus</i>	Threespine stickleback	Secure G, Critically Imperiled R, Endangered S P
<i>Umbra pygmaea</i>	Eastern mudminnow	Secure G, Vulnerable R
<i>Noturus gyrinus</i>	Tadpole madtom	Secure G, Critically Imperiled R, Endangered S P

G: Global status R: State Rank S: State Status P: State Proposed Status F: Federal Status
(For clarifications on statuses, see Table 6.2)

Source: [Pennsylvania Natural Heritage Program](#)

Exotic Aquatic Wildlife

A contributing factor to the loss of biodiversity in aquatic ecosystems is the introduction of exotic species. The Port of Philadelphia receives ships from all over the world. It is not uncommon for non-native or exotic species to be introduced through international shipping in ballast water or attached to ship hulls. Species such as the Asiatic clam (*Corbicula fluminea*), Flathead catfish (*Pylodictis olivaris*), Zebra mussel (*Dreissena polymorpha*), Common carp (*Cyprinus carpio*) and Snakehead (*Channidae* spp.) are examples of non-native species to the Delaware Estuary. Zebra mussels may cover boat hulls, pipelines and drinking water intakes. Common carp were introduced as a source of food and for sport, but their growing population threatens native aquatic vegetation. All species of Snakehead fishes have been added to the U.S. Fish and Wildlife Service's [injurious species list](#). Some species of Snakehead are able to survive out of water long enough to travel over land to other water bodies.

6.2 – Vegetation

Not unlike wildlife, vegetative species in the Delaware Direct Watershed have been adversely affected by the impacts of urbanization. In South Philadelphia, the conversion of floodplains and marshland into developed land has greatly reduced plant diversity. The transformation of natural lands into urban land decreases plant density and provides opportunity for invasive species to become established. In addition, commercial and residential landscaping has changed the inventory of plants found in the watershed.

Urban Forests

Urban forests consist of native tree species as well as exotic species introduced over time. As a result, urban forests often exhibit greater species diversity than surrounding, more natural lands. Approximately 57% of the tree species in Philadelphia are native to Pennsylvania. Notably, 18.2% of all species are native to Asia. The three most common tree species found in Philadelphia's urban forest are Black cherry (*Prunus serotina*), Crabapple (*Malus*), and Tree-of-heaven (*Ailanthus altissima*), a species native to China. Other species that appear in significant numbers are Tulip poplar (*Liriodendron tulipifera*), Red maple (*Acer rubrum*), Boxelder (*Acer negundo*), Northern red oak (*Quercus rubra*) and White mulberry (*Morus alba*).⁹

The USDA Forest Service recently published a report on the existing and possible tree canopy in Philadelphia. Tree canopy is important for both environmental and economic reasons, as it reduces stormwater runoff, improves air quality and raises property values. Philadelphia has an estimated 2.1 million trees, with canopy covering 15.7% of the city. Tree density amounts to roughly 25 trees/acre, which is comparable to tree density in other American cities such as San Francisco (22.5) and New York (26.4).

Philadelphia residents have the most land available to plant trees and control the majority of the City's tree canopy. Existing tree canopy in the Delaware Direct Watershed is generally very low, as much of the land has been developed or covered by impervious surface. Chinatown, North Philadelphia and South Philadelphia exhibit the lowest percentage (3% each) of tree canopy in the City. However, some areas of the watershed, such as the Navy Yard and Bridesburg, have a high percentage of land available for potential tree canopy. Table 6.6 summarizes information contained in the USDA Forest Service Report, [Assessing Urban Forest Effects and Values](#).¹⁰

Philadelphia is fortunate to have a large amount of municipal parkland (referred to as the Fairmount Park system) managed by the Philadelphia Department of Parks and Recreation (PP&R). Much of this land is wooded and minimally developed, providing significant habitat for flora and fauna. PP&R undertakes various environmental restoration projects with its 9,200 acres of parkland. The park's restoration activities include:

⁹ United States Department of Agriculture, *Assessing Urban Forest Effects and Values*, 2008

¹⁰ USDA, 2008

- Controlling and removing exotic invasive plants and replacing them with species native to Philadelphia County;
- Increasing the density and diversity of native plants in riparian zones, forests and other areas; and
- Constructing new and restored/expanded existing wetlands.

Table 6.6 –Philadelphia Urban Forest Summary

Feature	Measure
Number of trees	2.1 million
Tree cover	15.7%
Most common species	black cherry, crabapple, tree of heaven
Percentage of trees < 6-inches diameter	57.5%
Pollution removal	802 tons/year (\$3.9 million/year)
Carbon storage	530,000 tons (\$9.8 million)
Carbon sequestration	16,100 tons/year (\$297,000/year)
Building energy reduction	\$1,178,000/year
Avoided carbon emissions	\$14,400/year
Structural value	\$1.8 billion
Ton – short ton (U.S.) (2,000 lbs)	

USDA, 2008

Woody Plant Species

Philadelphia’s geographic location within the Delaware Basin allows for warm air to come up from the Delaware Bay, providing a milder temperature to the area. The combination of this mild temperature and sandy soils allows for species that typically inhabit more southern regions to live in this area (see Table 6.7). In pre-colonial Philadelphia, the forests consisted mostly of Sweet-gum (*Liquidambar styraciflua*) and Oak trees (*Quercus* spp.). The floodplains also would have had a strong influence on the type of species that grow in the area. In consistently wet areas, there were more Swamp white oaks (*Quercus bicolor*), Pin oaks (*Quercus palustris*), and Red maples (*Acer rubrum*). Along the banks of the river, Black willows (*Salix nigra*), River birches (*Betula nigra*), and Smooth alder (*Alnus serrulata*) were the dominant tree canopy. In floodplain areas that experienced frequent inundation, the forests were mostly American Sycamore (*Platanus occidentalis*), Silver maple (*Acer saccharinum*) Elm (*Ulmus* spp.), Eastern cottonwood (*Populus deltoids*), Common hackberry (*Celtis occidentalis*), Black walnut (*Juglans nigra*), Butternut (*Juglans cinerea*), Green ash (*Fraxinus pennsylvanica*), and

Box-elder (*Acer negundo*). Human influences have greatly reduced the area of historical floodplains in Philadelphia and along the Delaware River. Other common species in the area include American beech (*Fagus grandifolia*), Black cherry (*Prunus serotina*), Eastern black walnut (*Juglans nigra*), Tulip poplar (*Liriodendron tulipifera*), and Honey locust (*Gleditsia triacanthos*).¹¹

Table 6.7 -Native Woody Species in Philadelphia

Scientific Name	Common Name
<i>Acer negundo</i>	Box-elder
<i>Acer rubrum</i>	Red maple
<i>Acer saccharinum</i>	Silver maple
<i>Alnus serrulata</i>	Smooth alder
<i>Betula nigra</i>	River birch
<i>Carya cordiformis</i>	Bitternut hickory
<i>Carya glabra</i>	Pignut hickory
<i>Carya laciniosa</i>	Shellbark hickory
<i>Carya ovata</i>	Shagbark hickory
<i>Carya tomentosa</i>	Mockernut hickory
<i>Castanea dentata</i>	American chestnut
<i>Celtis occidentalis</i>	Common hackberry
<i>Chamaecyparis thyoides</i>	Atlantic white-cedar
<i>Clethra alnifolia</i>	Sweet pepperbush
<i>Fagus grandifolia</i>	American beech
<i>Fraxinus pennsylvanica</i>	Green ash
<i>Gaylussacia frondosa</i>	Dangleberry
<i>Ilex glabra</i>	Inkberry
<i>Ilex opaca</i>	American holly
<i>Ilex verticillata</i>	Winterberry
<i>Juglans cinerea</i>	Butternut
<i>Juglans nigra</i>	Black walnut
<i>Leucothoe racemosa</i>	Fetter-bush
<i>Liquidambar styraciflua</i>	Sweet-gum
<i>Magnolia virginiana</i>	Sweetbay magnolia
<i>Myrica pensylvanica</i>	Bayberry
<i>Nyssa sylvatica</i>	Blackgum
<i>Ostrya virginiana</i>	Hop-hornbeam
<i>Photinia melanocarpa</i>	Black chokeberry
<i>Pinus rigida</i>	Pitch pine
<i>Platanus occidentalis</i>	Sycamore
<i>Pogonia ophioglossoides</i>	Rose pogonia
<i>Populus deltoides</i>	Eastern cottonwood
<i>Quercus alba</i>	White oak
<i>Quercus bicolor</i>	Swamp-white oak
<i>Quercus coccinea</i>	Scarlet oak
<i>Quercus falcata</i>	Southern red oak
<i>Quercus palustris</i>	Pin oak

¹¹ PNHP, 2008

Quercus phellos	Willow oak
Quercus prinus	Chestnut oak
Quercus rubra	Northern red oak
Quercus velutina	Black oak
Rhododendron viscosum	Swamp azalea
Salix nigra	Black willow
Sassafras albidum	Sassafras
Ulmus americana	American elm
Ulmus rubra	Slippery elm
Vaccinium corymbosum	Highbush blueberry
Prunus serotina	Black cherry
Liriodendron tulipifera	Tulip poplar
Gleditsia triacanthos	Honey locust

NHI, 2008

Herbaceous Vegetation

Herbaceous vegetation is classified as plants without woody stems or bark trunks. Flowers, grasses and ferns are all herbaceous plants. Many of these species serve as ground cover. Typically, these plants will go dormant in the winter and produce new growth in the spring. Many herbaceous plants are known to be early-succession plants, which are the first to establish in an area that has been disturbed or cleared. Trees and scrub tend follow herbaceous plants in succession. Table 6.8 includes a listing of native herbaceous species to Philadelphia. Table 6.9 lists species of concern in Philadelphia.

Table 6.8- Native Herbaceous Species in Philadelphia

Scientific Name	Common Name
Actaea racemosa	Black cohosh
Actaea pachypoda	Doll's eyes
Agastache nepetoides	Yellow giant hyssop
Agastache scrophulariaefolia	Purple hyssop
Agrimonia parviflora	Southern agrimony
Alisma subcordatum	Southern water-plantain
Anaphalis margaritacea	Pearly everlasting
Anemone virginiana	Tall anemone
Apocynum cannabinum	Indian hemp
Aquilegia canadensis	Columbine
Arisaema triphyllum	Jack-in-the-pulpit
Asarum canadense	Wild ginger
Asclepias incarnata	Swamp milkweed
Asclepias syriaca	Common milkweed
Asclepias tuberosa	Butterfly-weed
Aster cordifolius	Blue wood aster
Aster divaricatus	White wood aster
Aster laevis	Smooth aster
Aster lateriflorus	Calico aster
Aster linariifolius	Stiff-leaved aster
Aster macrophyllus	Big-leaf aster
Aster novae-angliae	New England aster

<i>Aster novi-belgii</i>	New York aster
<i>Aster puniceus</i>	Purple-stemmed aster
<i>Baptisia tinctoria</i>	Wild indigo
<i>Bidens cernua</i>	Bur marigold
<i>Bidens comosa</i>	Beggars-ticks
<i>Bidens connata</i>	Beggars-ticks
<i>Bidens frondosa</i>	Beggars-ticks
<i>Caltha palustris</i>	Marsh marigold
<i>Caulophyllum thalictroides</i>	Blue cohosh
<i>Chamaecrista fasciculata</i>	Partridge-pea
<i>Chelone glabra</i>	Turtlehead
<i>Claytonia virginica</i>	Spring-beauty
<i>Clematis virginiana</i>	Virgin's bower
<i>Desmodium canadense</i>	Showy tick-trefoil
<i>Dicentra cucullaria</i>	Dutchman's breeches
<i>Dodecatheon media</i>	Shooting-star
<i>Epilobium coloratum</i>	Purple-leaved willow herb
<i>Eupatorium fistulosum</i>	Joe-pye-weed
<i>Eupatorium hyssopifolium</i>	Hyssop-leaved eupatorium
<i>Eupatorium perfoliatum</i>	Boneset
<i>Eupatorium purpureum</i>	Joe-pye-weed
<i>Eupatorium rugosum</i>	White snakeroot
<i>Euphorbia corollata</i>	Flowering spurge
<i>Gentiana clausa</i>	Closed gentian
<i>Geranium maculatum</i>	Wild geranium
<i>Geum laciniatum</i>	Rough avens
<i>Helenium autumnale</i>	Sneezeweed
<i>Helianthus decapetalus</i>	Thin-leaved sunflower
<i>Helianthus giganteus</i>	Swamp sunflower
<i>Heliopsis helianthoides</i>	Ox-eye
<i>Heracleum lanatum</i>	Cow parsnip
<i>Heuchera americana</i>	Alumroot
<i>Hibiscus moscheutos</i>	Swamp mallow
<i>Houstonia caerulea</i>	Bluets
<i>Hypericum punctatum</i>	Spotted St. John's-wort
<i>Hypoxis hirsuta</i>	Yellow star-grass
<i>Iris versicolor</i>	Blue-flag iris
<i>Krigia biflora</i>	Two-flowered cynthia
<i>Lespedeza capitata</i>	Round-headed bush-clover
<i>Lespedeza hirta</i>	Hairy bush-clover
<i>Liatris spicata</i>	Spiked gayfeather
<i>Lillium canadense</i>	Canada lily
<i>Lillium superbum</i>	Turk's cap-lily
<i>Lobelia cardinalis</i>	Cardinal flower
<i>Lobelia siphilitica</i>	Great-blue lobelia
<i>Ludwigia alternifolia</i>	Seedbox
<i>Mertensia virginica</i>	Virginia bluebells
<i>Maianthemum racemosum</i>	False-Solomon's seal

<i>Mimulus alatus</i>	Winged monkey-flower
<i>Mimulus ringens</i>	Allegheny monkey-flower
<i>Mitchella repens</i>	Partridge-berry
<i>Monarda didyma</i>	Bee-balm
<i>Monarda fistulosa</i>	Wild bergamot
<i>Oenothera biennis</i>	Evening-primrose
<i>Oenothera fruticosa</i>	Sundrops
<i>Peltandra virginica</i>	Arrow-arum
<i>Penstemon digitalis</i>	White beardtongue
<i>Penstemon hirsutus</i>	Hairy beardtongue
<i>Penthorum sedoides</i>	Ditch stone-crop
<i>Phlox maculata</i>	Wild sweet-william
<i>Phlox paniculata</i>	Summer phlox
<i>Physostegia virginiana</i>	False dragonhead
<i>Podophyllum peltatum</i>	Mayapple
<i>Polemonium reptans</i>	Jacob's ladder
<i>Polygonatum biflorum</i>	Solomon's seal
<i>Polygonum arifolium</i>	Halberd-leaved tearthumb
<i>Pontederia cordata</i>	Pickrel-weed
<i>Porteranthus trifolius</i>	Bowman's root
<i>Pycnanthemum tenuifolium</i>	Narrow-leaved mountain mint
<i>Pycnanthemum virginianum</i>	Mountain mint
<i>Rudbeckia laciniata</i>	Cutleaf coneflower
<i>Rudbeckia triloba</i>	Three-lobed coneflower
<i>Sagittaria latifolia</i>	Arrowhead
<i>Sanguinaria canadensis</i>	Bloodroot
<i>Saururus cernuus</i>	Lizard's tail
<i>Sedum ternatum</i>	Wild stone crop
<i>Senecio aureus</i>	Golden-ragwort
<i>Senna hebecarpa</i>	Wild senna
<i>Sisyrinchium angustifolium</i>	Blue-eyed grass
<i>Smilax pulverulenta</i>	Carrion-flower
<i>Solidago bicolor</i>	Silver-rod
<i>Solidago ceasia</i>	Blue-stem goldenrod
<i>Solidago flexicaulis</i>	Zigzag goldenrod
<i>Solidago gigantea</i>	Smooth goldenrod
<i>Solidago juncea</i>	Early goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Solidago odora</i>	Sweet goldenrod
<i>Solidago puberula</i>	Downy goldenrod
<i>Solidago rugosa</i>	Wrinkle-leaf goldenrod
<i>Solidago sempervirens</i>	Sea-side goldenrod
<i>Spiranthes cernua</i>	Nodding ladies'-tresses
<i>Symphotrichum pilosum</i> v. <i>pilosum</i>	Heath aster
<i>Thalictrum dioicum</i>	Early meadow-rue
<i>Thalictrum pubescens</i>	Tall meadow-rue
<i>Thalictrum thalictroides</i>	Rue-anemone

<i>Tradescantia virginiana</i>	Spiderwort
<i>Trillium cernuum</i>	Nodding trillium
<i>Uvularia perfoliata</i>	Bellwort
<i>Uvularia sessifolia</i>	Wild oats
<i>Verbena hastata</i>	Blue vervain
<i>Verbena urticifolia</i>	White vervain
<i>Veronia novaborensis</i>	New York ironweed
<i>Viola blanda</i>	Sweet white violet
<i>Viola labradorica</i>	American dog violet
<i>Viola sororia</i>	Common blue violet
<i>Viola striata</i>	Striped violet
<i>Zizia aptera</i>	Heart-leaved golden alexander
<i>Zizia aurea</i>	Golden alexander

Source: Selected Native Plants of Philadelphia: Herbaceous Plants (Wildflower, Ferns, Grasses, Sedges, Rushes)

Table 6.9- Vegetation Species of Concern in Pennsylvania

Scientific Name:	Common Name:	Status
<i>Aletris farinosa</i>	Colic-root	Secure G, Critically Imperiled R, Endangered P
<i>Alopecurus aequalis</i>	Short-awn foxtail	Secure G, Vulnerable R, Threatened P
<i>Ammannia coccinea</i>	Scarlet ammannia	Secure G, Imperiled R, Endangered S, Threatened P
<i>Andropogon gyrans</i>	Elliott's beardgrass	Secure G, Vulnerable R, Rare P
<i>Aristida longespica</i> var. <i>geniculata</i>	Spiked needlegrass	Secure G, Watch P
<i>Asclepias rubra</i>	Red milkweed	Secure G, Extirpated R S P
<i>Asclepias variegata</i>	White milkweed	Secure G, Critically Imperiled R, Endangered P
<i>Baccharis halimifolia</i>	Eastern baccharis	Secure G, Vulnerable R, Rare S P
<i>Bidens bidentoides</i>	Swamp beggar-ticks	Vulnerable G, Critically Imperiled R, Threatened S, Endangered P
<i>Bidens laevis</i>	Beggar-ticks	Secure G, Critically Imperiled R, Endangered P
<i>Chamaesyce polygonifolia</i>	Small sea-side Spurge	Secure G, Imperiled R, Threatened S P
<i>Chasmanthium laxum</i>	Slender sea-oats	Secure G, Critically Imperiled R, Endangered SP
<i>Chrysopsis mariana</i>	Maryland golden-aster	Secure G, Critically Imperiled R, Threatened S, Endangered P
<i>Cirsium horridulum</i>	Horrible thistle	Secure G, Critically Imperiled R, Endangered SP
<i>Cladium</i>	Twig rush	Secure G, Imperiled R, Endangered SP

mariscoides		
Cuscuta campestris	Dodder	Secure G, Imperiled R, Threatened P
Cuscuta pentagona	Field dodder	Secure G, Imperiled R, Threatened P
Cyperus diandrus	Umbrella flatsedge	Secure G, Imperiled R, Endangered SP
Desmodium laevigatum	Smooth tick-trefoil	Secure G
Desmodium nuttallii	Nuttalls' tick-trefoil	Secure G, Imperiled R
Desmodium obtusum	Stiff tick-trefoil	Secure G
Echinochloa walteri	Walter's barnyard-grass	Secure G, Critically Imperiled R, Endangered SP
Elatine americana	Long-stemmed water-wort	Apparently Secure G, Endangered R P, Extirpated S
Eleocharis obtusa var. peasei	Wrights spike Rush	Secure G, Critically Imperiled R, Endangered SP
Eleocharis parvula	Little-spike spike-rush	Secure G, Critically Imperiled R, Endangered SP
Elephantopus carolinianus	Elephant's foot	Secure G, Vulnerable R, Endangered S, Rare P
Ellisia nyctelea	Ellisia	Secure G, Imperiled R, Threatened SP
Erianthus giganteus	Sugar cane plumegrass	Secure G, Extirpated RSP
Eryngium aquaticum	Marsh eryngo	Apparently Secure G, Extirpated RSP
Eupatorium rotundifolium	A eupatorium	Secure G, Vulnerable R
Euthamia tenuifolia	Grass-leaved goldenrod	Secure G, Critically Imperiled R, Threatened SP
Fimbristylis annua	Annual fimbry	Secure G, Imperiled R, Threatened SP
Galactia regularis	Eastern milk-pea	Secure G, Extirpated RSP
Gentiana saponaria	Soapwort gentian	Secure G, Critically Imperiled R, Endangered P
Glyceria obtusa	Blunt manna-grass	Secure G, Critically Imperiled R, Endangered SP
Gratiola aurea	Golden hedge-hyssop	Secure G, Critically Imperiled R, Endangered P
Heteranthera multiflora	Multiflowered mud-plantain	Apparently Secure G, Critically Imperiled R, Endangered SP
Hypericum stragulum	St Andrew's-cross	Apparently Secure G, Imperiled R, Threatened P
Isotria medeoloides	Small-whorled pogonia	Imperiled G, Critically Imperiled R, Endangered SP, Threatened F
Juncus biflorus	Grass-leaved rush	Secure G, Imperiled R, Threatened P
Juncus dichotomus	Forked rush	Secure G, Critically Imperiled R, Endangered SP
Juncus scirpoides	Scirpus-like rush	Secure G, Critically Imperiled R, Endangered SP
Juniperus communis	Common juniper	Secure G, Imperiled R
Lathyrus palustris	Vetchling	Secure G, Critically Imperiled R, Endangered P
Lathyrus venosus	Veiny pea	Secure G, Imperiled R, Endangered P
Lemna obscura	Little water duckweed	Secure G, Extirpated RSP
Lemna perpusilla	Minute duckweed	Secure G, Critically Imperiled R

<i>Lemna valdiviana</i>	Pale duckweed	Secure G, Historical R, Extirpated SP
<i>Leucothoe racemosa</i>	Swamp dog-hobble	Secure G, Vulnerable R, Threatened P
<i>Limosella australis</i>	Awl-shaped mudwort	Secure G, Extirpated R S P
<i>Lycopus rubellus</i>	bugleweed	Secure G, Critically Imperiled R, Endangered S P
<i>Lyonia mariana</i>	Stagger-bush	Secure G, Critically Imperiled R, Endangered S P
<i>Lythrum alatum</i>	Winged-loosestrife	Secure G, Critically Imperiled R, Endangered P
<i>Micranthemum micranthemoides</i>	Nuttall's mud-flower	Possibly Extinct G, Extirpated R S P
<i>Monarda punctata</i>	Spotted Bee-balm	Secure G, Historical R, Endangered S P
<i>Muhlenbergia uniflora</i>	Fall Dropseed muhly	Secure G, Imperiled R, Endangered S , Threatened P
<i>Opuntia humifusa</i>	Prickly-pear cactus	Secure G, Vulnerable R, Rare S P
<i>Oxypolis rigidior</i>	Stiff cowbane	Secure G, Imperiled R, Threatened P
<i>Panicum commonsianum</i> var. <i>commonsianum</i>	Commons' panic-grass	Secure G, Historical R, Extirpated P
<i>Panicum polyanthes</i>	Panic-grass	Secure G, Apparently Secure R
<i>Panicum scoparium</i>	Velvety panic-grass	Secure G, Critically Imperiled R, Endangered S P
<i>Phaseolus polystachios</i>	Wild kidney bean	Secure G, Critically Imperiled R, Endangered P
<i>Phlox pilosa</i>	Downy phlox	Secure G, Critically Imperiled R, Endangered P
<i>Phyllanthus caroliniensis</i>	Carolina leaf-flower	Secure G, Critically Imperiled R, Endangered S P
<i>Pinus echinata</i>	Short-leaf pine	Secure G, Critically Imperiled R, Threatened P
<i>Piptochaetium avenaceum</i>	Blackseed Needlegrass	Secure G, Critically Imperiled R, Endangered P
<i>Pluchea odorata</i>	Shrubby camphor-weed	Secure G, Critically Imperiled R, Endangered P
<i>Poa autumnalis</i>	Autumn bluegrass	Secure G, Critically Imperiled R, Endangered S P
<i>Potamogeton vaseyi</i>	Vasey's pondweed	Apparently Secure G, Critically Imperiled R, Endangered S P
<i>Prenanthes serpentaria</i>	Lion's-foot	Secure G, Vulnerable R, Threatened P
<i>Ptilimnium capillaceum</i>	Mock bishop-weed	Secure G, Extirpated R, Endangered S, Extirpated P
<i>Pycnanthemum verticillatum</i> var. <i>pilosum</i>	Hairy mountain-mint	Secure G, Historical R, Undetermined S, Extirpated P
<i>Rallus elegans</i>	King rail	Apparently Secure G, Critically Imperiled R, Endangered S P
<i>Rallus limicola</i>	Virginia rail	Secure G, Vulnerable R
<i>Ranunculus aquatilis</i> var. <i>diffusus</i>	White water-crowfoot	Secure G, Vulnerable R, Rare S
<i>Sagittaria calycina</i> var. <i>spongiosa</i>	Long-lobed arrow-head	Secure G, Critically Imperiled R, Endangered S P

<i>Sagittaria subulata</i>	Subulate arrowhead	Apparently Secure G, Vulnerable R, Rare S P
<i>Schoenoplectus smithii</i>	Smith's bulrush	Secure G, Critically Imperiled R, Endangered S P
<i>Scleria pauciflora</i>	Few flowered nutrush	Secure G, Imperiled R, Threatened S P
<i>Senna marilandica</i>	Wild senna	Secure G, Vulnerable R, Rare P
<i>Sericocarpus linifolius</i>	Narrow-leaved white-topped aster	Secure G, Critically Imperiled R, Endangered S P
<i>Sisyrinchium fuscatum</i>	Sand blue-eyed grass	Secure G, Historical R, Extirpated S P
<i>Solidago uliginosa</i>	Bog goldenrod	Secure G, Imperiled R, Threatened P
<i>Sparganium androcladum</i>	Branching bur-reed	Secure G, Critically Imperiled R, Endangered S P
<i>Spiranthes lucida</i>	Shining ladies'-tresses	Secure G, Vulnerable R, Threatened P
<i>Spiranthes vernalis</i>	Spring ladies'-tresses	Secure G, Critically Imperiled R, Endangered S P
<i>Strophostyles umbellata</i>	Wild bean	Secure G, Imperiled R, Endangered P
<i>Stylosanthes biflora</i>	Pencilflower	Secure G, Imperiled R, Endangered P
<i>Symphyotrichum novi-belgii</i>	New York aster	Secure G, Imperiled R, Threatened S P
<i>Triphora trianthophora</i>	Nodding pogonia	Vulnerable G, Historical R, Endangered S P
<i>Triplasis purpurea</i>	Purple sandgrass	Apparently Secure G, Critically Imperiled R, Endangered S P
<i>Tripsacum dactyloides</i>	Eastern gamma-grass	Secure G, Critically Imperiled R, Endangered P
<i>Veratrum virginicum</i>	Virginia bunchflower	Secure G, Critically Imperiled R, Endangered P
<i>Vernonia glauca</i>	Tawny ironweed	Secure G, Critically Imperiled R, Endangered S P
<i>Viola brittoniana</i>	Coast violet	Apparently Secure G, Critically Imperiled R, Endangered S P
<i>Woodwardia areolata</i>	Netted chainfern	Secure G, Imperiled R, Threatened P
<i>Zizania aquatica</i>	Indian wild Rice	Secure G, Vulnerable R, Rare S P
<i>Magnolia virginiana</i>	Sweet bay magnolia	Secure G, Imperiled R, Threatened S P
<i>Quercus falcata</i>	Southern red oak	Secure G, Critically Imperiled R, Endangered S P
<i>Quercus phellos</i>	Willow oak	Secure G, Imperiled R, Endangered S P
<i>Schoenoplectus fluviatilis</i>	River bulrush	Secure G, Vulnerable R, Rare S P

G: Global status R: State Rank S: State Status P: State Proposed Status F: Federal Status
(For clarifications on statuses, see Table 6.2)

(Source: [Pennsylvania Natural Heritage Program](#))

Invasive Vegetation

An invasive species is an introduced organism within an area of concern that is likely to cause environmental or economic harm. Native species have to fight for space and

resources against introduced invasive species. View Table 6.10 for a list of invasive plant species along the Delaware Riverfront.

Table 6.10- Invasive Species in Philadelphia:

Scientific Name:	Common Name:
<i>Acer platanoides</i>	Norway maple
<i>Ailanthus altissima</i>	Tree-of-heaven
<i>Akebia quinata</i>	Akebia
<i>Alliaria petiolata</i>	Garlic mustard
<i>Ampelopsis brevipedunculata</i>	Porcelain berry
<i>Berberis</i> spp	Barberry
<i>Berberis thunbergii</i>	Japanese barberry
<i>Broussonetia papyrifera</i>	Paper mulberry
<i>Celastrus orbiculatus</i>	Asiatic bittersweet
<i>Diervilla</i> spp	Bush honeysuckles
<i>Elaeagnus umbellata</i>	Autumn olive
<i>Hedera helix</i>	English ivy
<i>Ligustrum vulgare</i>	Common privet
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Lythrum salicaria</i>	Purple loosestrife
<i>Morus alba</i>	White mulberry
<i>Paulownia tomentosa</i>	Princess tree
<i>Polygonum cuspidatum</i>	Japanese knotweed
<i>Polygonum perfoliatum</i>	Mile-a-minute
<i>Populus alba</i>	White poplar
<i>Pueraria lobata</i>	Kudzu
<i>Rosa multiflora</i>	Multiflora rose
<i>Ulmus pumila</i>	Siberian elm
<i>Vitis</i> sp.	Wild grape

Source: [Fairmount Park Invasive Plant Species](#)

6.3 – Pennsylvania Natural Diversity Inventory (PNDI) Species

The Pennsylvania Natural Diversity Inventory (PNDI) is used to identify rare or significant ecological features within the State that require special consideration when reviewing activities that require a DEP permit, approval or authorization. This inventory includes plants, animals, natural communities and geologic features. Potential adverse impacts to threatened and endangered species can be identified during the project development phase of the permit review process. Measures to avoid, minimize or otherwise mitigate those impacts are explored, documented and considered during the permit review process. ¹²Table 6.11 provides a breakdown of the rare, threatened, endangered, and candidate species found in Philadelphia.

¹² Pennsylvania Department of Environmental Protection, Policy for Pennsylvania Natural Diversity Inventory Coordination During Permit Review and Evaluation, 2009

Table 6.11- PNDI Species in Philadelphia

Scientific Name:	Common Name:	PNDI Status:
<i>Acipenser brevirostrum</i>	Shortnose sturgeon	Endangered
<i>Acipenser oxyrinchus</i>	Atlantic sturgeon	Endangered
<i>Enneacanthus obesus</i>	Banded sunfish	Endangered
<i>Gasterosteus aculeatus</i>	Threespine stickleback	Endangered
<i>Glyptemys muhlenbergii</i>	Bog turtle	Endangered
<i>Noturus gyrinus</i>	Tadpole madtom	Endangered
<i>Pseudemys rubriventris</i>	Redbelly turtle	Threatened
<i>Rana sphenoccephala</i>	Coastal plain leopard frog	Endangered
<i>Umbra pygmaea</i>	Eastern mudminnow	Candidate

See Defined Species Concern Levels for clarifications on Statuses

Source: [Fish & Boat Endangered Species Code](#), 1984

6.4 - Important Habitats

Wetlands

Wetlands play an important role in maintaining regional biodiversity. These transitional locations between aquatic and terrestrial areas are inhabited by specific wetland vegetation and wildlife. Species that are found in Philadelphia’s wetlands are listed in Table 6.11. Wetlands include fens, bogs, marshes and swamps. Conservation of these areas is of extreme importance for the Delaware River ecosystem and for the region as a whole. Many migratory species come to the Philadelphia area to rest and breed. Although man-made wetlands are less productive than natural ones, wetland creation is necessary to counterbalance the prior destruction of natural areas.

Scientists from the Philadelphia Water Department (PWD) identified and documented locations of remnant freshwater tidal wetlands in 2006 and 2007. They identified and mapped 187 acres of existing or potential tidal wetlands along the Delaware River waterfront. Of the existing wetland acreage, 27 acres were identified as potential enhancement sites. Based on those sites, areas for potential wetland creation were also identified. Figures 6.3 - 6.5 illustrate the existing Delaware Riverfront wetlands, as well as the potential wetland enhancement and creation sites identified by PWD in 2007.

The Philadelphia Water Department’s Wetland and Stream Project Registry (2007) is an initiative that resulted in a list and a map of potential projects within Philadelphia’s watersheds. The registry is designed to be an inventory of potential projects and provides a method for the valuation of the mitigation projects. These projects include wetland creation, wetland enhancement, wetland restoration, invasive management, wetland preservation, stream restoration, stream day-lighting, dam removal and habitat restoration. Currently, there are more than 200 candidate sites for projects on the registry. Figure 6.6 shows a map of the registry. Also, Table 6.12 lists plant species found in the Philadelphia wetlands.

Table 6.12- Species typically found in wetlands in Philadelphia

Scientific Name	Common Name
<i>Amaranthus cannabinus</i>	Salt-marsh water-hemp
<i>Bidens</i> spp.	Beggar-ticks
<i>Carex folliculata</i>	Northern long sedge
<i>Carex leptalea</i>	Bristlystalked sedge
<i>Carex seorsa</i>	Weak stellate sedge
<i>Chrysosplenium americanum</i>	Golden saxifrage
<i>Coptis trifolia</i>	Goldenthread
<i>Dryopteris carthusiana</i>	Spinulose wood fern
<i>Eurybia radula</i>	Rough aster
<i>Gallium asprellum</i> *	Rough bedstraw
<i>Galium triflorum</i>	Sweet-scented bedstraw
<i>Glyceria melicaria</i>	Slender mannagrass
<i>Hibiscus moscheutos</i>	Crimsoneyed rosemallow
<i>Impatiens capensis</i>	Jewelweed
<i>Leersia oryzoides</i>	Rice cutgrass
<i>Lindera benzoin</i>	Spicebush
<i>Ludwigia peploides</i>	Primrose-willow
<i>Nuphar lutea</i>	Spatterdock
<i>Onoclea sensibilis</i>	Sensitive fern
<i>Osmunda cinnamomea</i>	Cinnamon fern
<i>Peltandra virginica</i>	Green arrow-arum
<i>Pilea pumila</i>	Clearweed
<i>Polygonum arifolium</i>	Halberdleaf tearthumb
<i>Polygonum punctatum</i>	Dotted smartweed
<i>Pontederia cordata</i>	Pickerelweed
<i>Sagittaria latifolia</i>	Broadleaf arrowhead
<i>Schoenoplectus fluviatilis</i>	River bulrush
<i>Sium suave</i>	Hemlock waterparsnip
<i>Symplocarpus foetidus</i>	Skunk cabbage
<i>Zizania aquatica</i>	Annual wild rice

*also observed by PWD
NHI, 2008

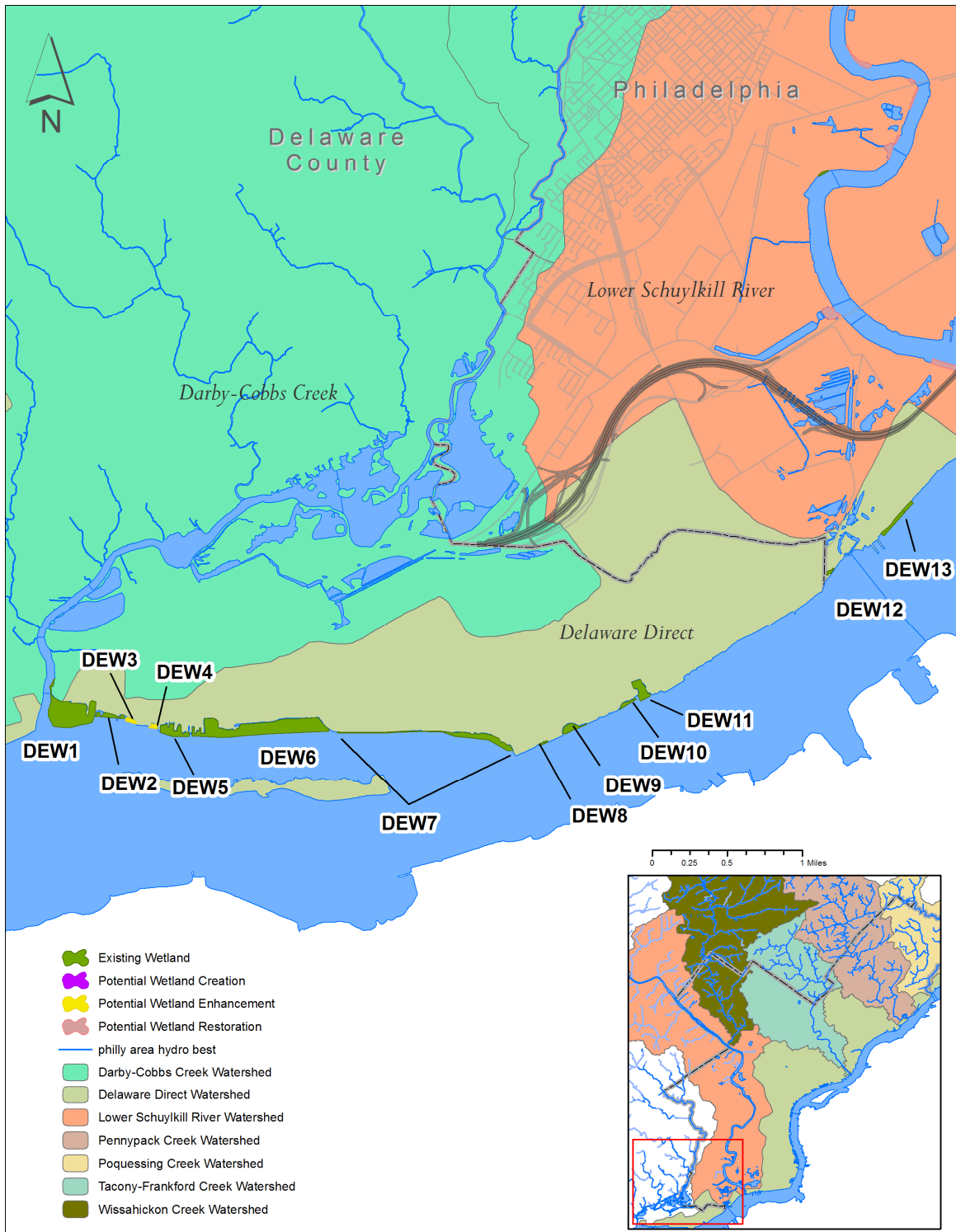


Figure 6.3 - Upper Delaware Estuary Existing Wetland Areas, Potential Wetland Enhancement Areas, and Potential Wetland Creation Areas, Lower Study Area
 Source: PWD

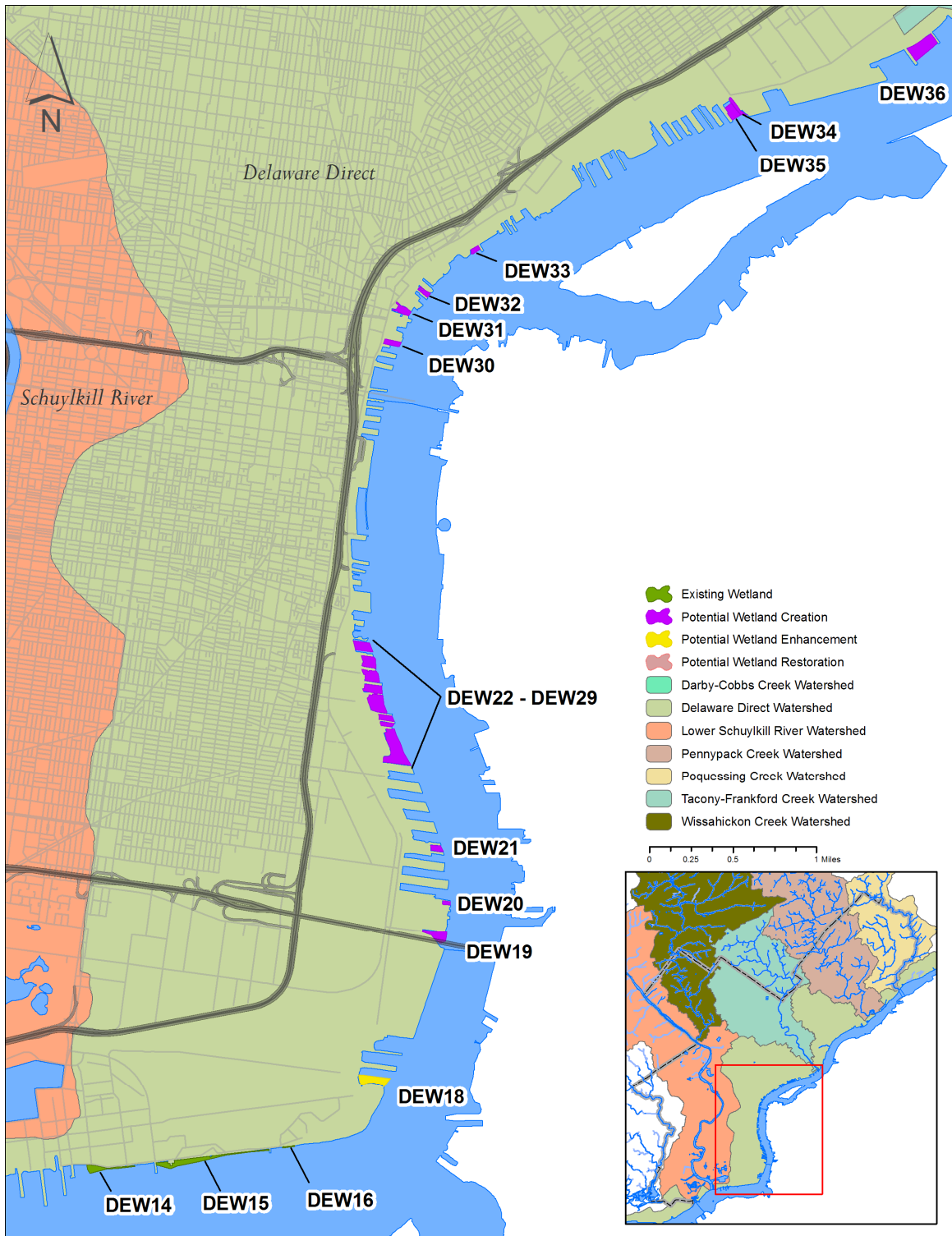


Figure 6.4 - Upper Delaware Estuary Existing Wetland Areas, Potential Wetland Enhancement Areas, and Potential Wetland Creation Areas, Middle Study Area
 Source: PWD

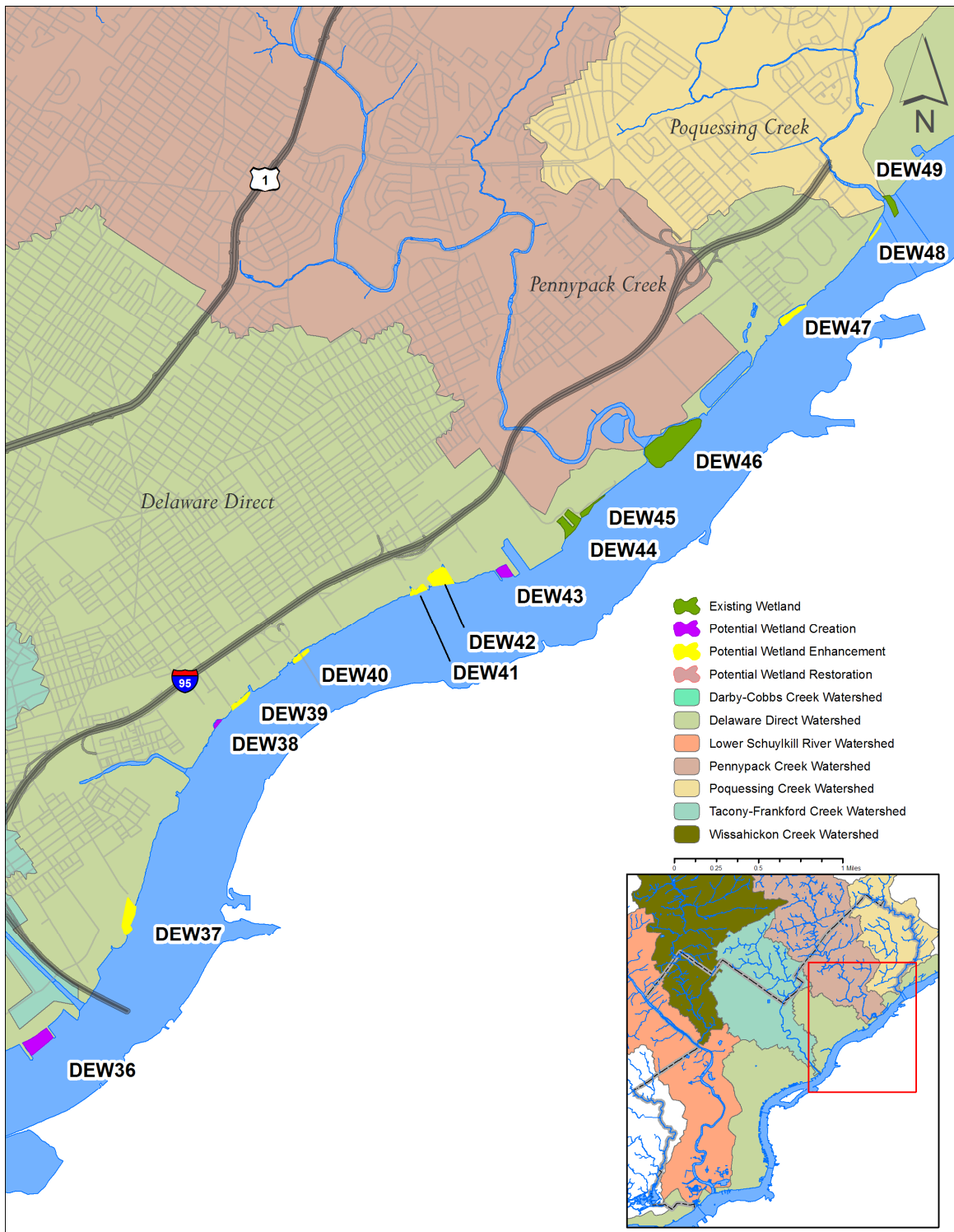


Figure 6.5 - Upper Delaware Estuary Existing Wetland Areas, Potential Wetland Enhancement Areas and Potential Wetland Creation Areas, Upper Study Area
 Source: PWD

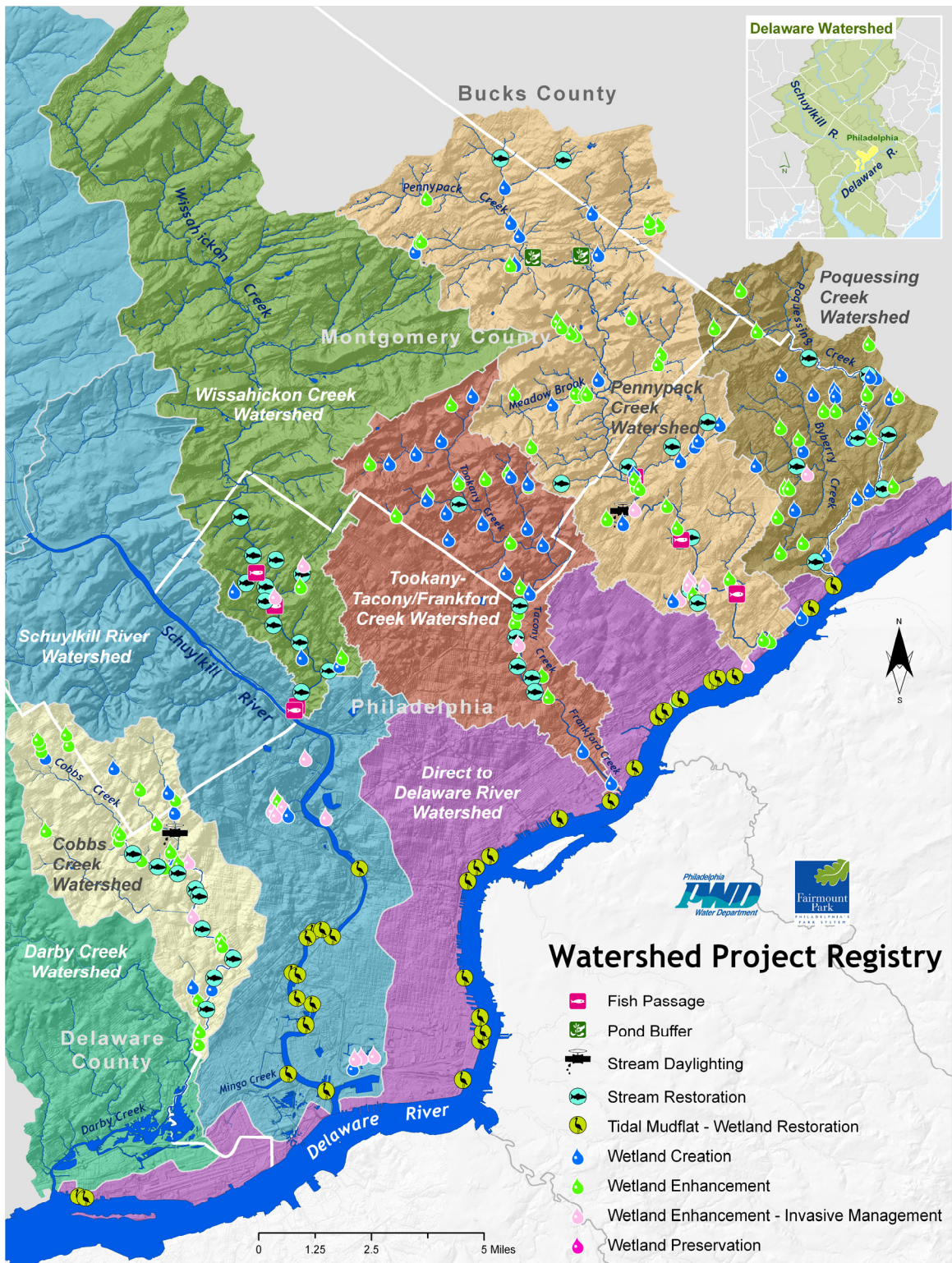


Figure 6.6 - Philadelphia Wetland and Stream Project Registry
 Source: PWD

Natural Heritage Inventory of Philadelphia County: Conservation Sites

The Natural Heritage Inventory contains information on the general locations of rare, threatened and endangered species, and identifies areas in need of habitat restoration. General management and restoration recommendations accompany each site description to help protect these natural communities, rare plants and animals, as well as to enhance the quality of the existing green space and open space. The recommendations are based on the biological needs of the communities and species and the efforts necessary to maintain the health of the natural system. The National Heritage Inventory is not an inventory of open space, but rather a conservation tool based on the best available information. View figure 6.7 for NHI Significance and Conservation Priority Sites in Philadelphia, including those within the Delaware Direct Watershed.

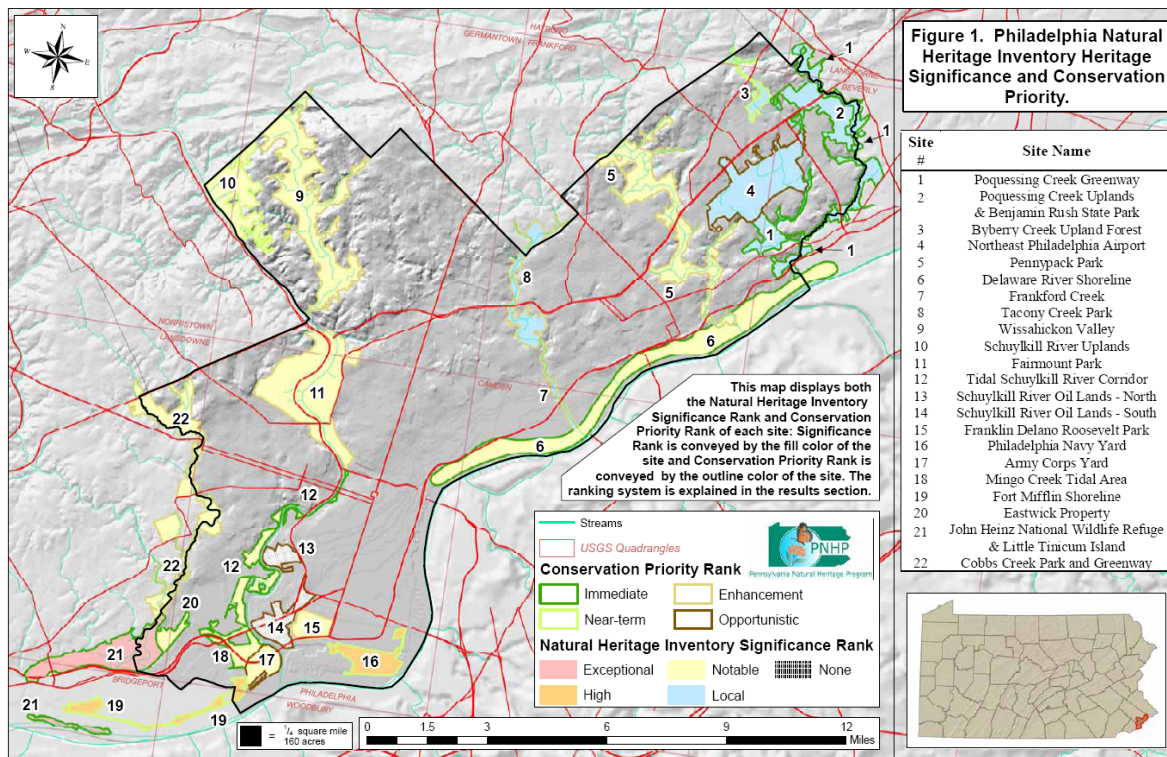


Figure 6.7 - Natural areas inventory in the Delaware Direct Watershed

Source: PNHP

In the Delaware Direct Watershed, the following sites are listed as Conservation Priorities:

- Delaware River Shoreline
- Philadelphia Navy Yard
- Army Corps Yard

The following information provides an overview of these sites and their significance as presented in the NHI. The [NHI of Philadelphia County](#) should be consulted for more detailed information.

Delaware River Shoreline

Conservation Priority: Immediate

This area is positioned for dense urban redevelopment which, if done in the traditional manner, will further degrade the biological value of the small areas of natural habitat that remain within the site. It is very important that any development within this site account for the placement of structures with the 100-and 500-year FEMA floodplains and allow for natural habitat to remain along the tidal Delaware River shoreline.

Natural Heritage Significance: Notable

This extensive site along the Delaware River shoreline is tidally influenced along its length and has the ability to support tidal species of concern throughout the site. The species of concern noted within this site are only found in specific areas where tidal habitat remains protected and in a few of the more naturally managed park.

Philadelphia Navy Yard

Conservation Priority: Near-term

Managed by the Philadelphia Industrial Development Corporation, the remains of the Philadelphia Navy Yard are slated for redevelopment. However, this process has been slowed by the costs associated with the project. As redevelopment plans are created for the currently undeveloped areas it will be important to assess the environmental impacts of developing a site that hosts numerous species of concern, was formerly an island, and is almost entirely within the 100-year FEMA floodplain.

Natural Heritage Significance: High

Large areas of the Navy Yard were reverting to natural cover, opening them up to colonization by grassland species with the lower, wetter areas supporting wetland species. The site supports 72 native plant species with an additional 46 non-native plant species recorded at the site. Of these plant species, five are listed as species of concern in the Commonwealth. An additional two bird species of concern are found utilizing the Navy Yard.

Army Corps Yard

Conservation Priority: Opportunistic

This site is still used by the Army Corps for maintenance of the Delaware River shipping channel; however, if the site were to become available for other purposes, restoration to a freshwater tidal community should be examined.

Natural Heritage Significance: Notable

This site provides excellent hunting habitat for adult dragonflies and damselflies, with two species of concern noted at the site feeding on the extensive aggregation of insects over the ponds. One of the local peregrine falcons (*Falco peregrinus*) has also been observed feeding at this location. It seems likely that these species of concern are reproducing in the surrounding landscape and are simply refueling and maturing here.